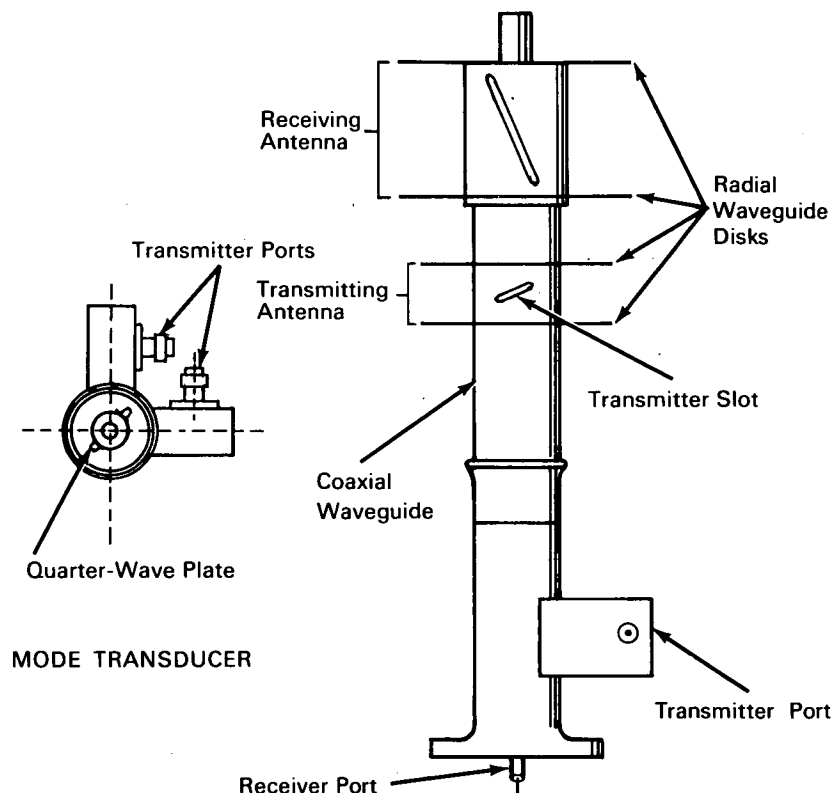


NASA TECH BRIEF



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Omnidirectional Antennas Transmit and Receive Over Large Bandwidth



The problem:

To provide an antenna system capable of exchanging wideband signals between two distant ground stations using satellite airborne equipment as the interconnecting link or relay.

The solution:

Low-gain antennas having wide angular coverage with circular polarization are mounted adjacently on a

single mast extending from the satellite. Two decoupled ports or inputs on the transmitting antenna eliminate switching problems when using two transmitters on different frequencies.

How it's done:

The transmitting antenna consists of two major components: the mode transducer and the radiator. The mode transducer consists of two decoupled input ports

(continued overleaf)

at the base of the antenna and a quarter-wave plate between the two ports and the transmitting antenna. Each input port consists of a short section of rectangular waveguide coupling to the coaxial waveguide through a narrow longitudinal slot cut in the outer conductor of the coaxial waveguide. The coaxial line from a transmitter excites a short probe through the broad face of the rectangular waveguide section. For proper operation, the two ports are oriented at right angles so that the modes excited in the coaxial waveguide will be orthogonal. In addition, the ports are offset longitudinally one guide-wavelength to reduce the direct cross-coupling between ports.

The quarter-wave plate consists of two longitudinal metal ridges attached on opposite sides of the coaxial waveguide inner conductor. The plane of the ridges lies at 45 degrees with respect to the orthogonal input ports. The dimensions of the ridges are adjusted to convert a linearly polarized wave from either of the input ports to a circularly polarized wave traveling toward the radiating section. Ends of the ridges are tapered to prevent reflections.

The radiator consists of eight equally spaced slots cut in the outer conductor of the coaxial waveguide above the quarter-wave plate and a radial waveguide made of two parallel metal disks. The slots are approximately one-half wave in length and are inclined at an angle with respect to the waveguide axis to provide both axial and tangential radiation components. The

spacing and diameter of the two disks are adjusted to produce left-hand circularly polarized radiation for excitation of either input port.

The receiving antenna consists of four inclined slots cut in a metal tube and enclosed between two radial disks. This antenna feeds a TEM mode coaxial line extending through the inner conductor of the coaxial waveguide for the transmitting antenna. Right-hand circular polarization is produced by proper adjustment of the disk geometry.

Notes:

1. The probe length and location, the positioning of the shorting plate in the rectangular waveguide, the slot dimensions, and the positioning of the slot from the shorting disk in the coaxial waveguide may be adjusted to provide an impedance match through the transitions of the waveguide.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland, 20771
Reference: B66-10133

Patent status:

No patent action is contemplated by NASA.

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